Appendix B

BENTHIC MACROINVERTEBRATE TAXONOMY RESULTS

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Subject: Benthic Macroinvertebrate Results
La Sal Creek Watershed Project

Introduction

Benthic macroinvertebrate (macroinvertebrates) samples were collected from three reference sites and two sites downstream from old abandoned uranium mines in streams draining the La Sal Creek watershed in San Juan County, Utah. Samples were collected between October 14 and 20, 2004, by Au' Authum Ki, Inc. These baseline data were collected to assess the present condition of the macroinvertebrate population and will be used as input to the BLM Streamline Risk Assessment.

Methods

Samples were semi-quantitatively collected from five sampling locations using a D-frame kick net with 500-micron mesh. Samples were collected from all representative habitats found at each site including riffle, run, pool, and bank areas. Samples from each of the representative habitats were then combined into one composite sample for taxonomic analysis. The area sampled for each habitat type was recorded to determine the total area sampled per site.

Each sample was labeled and preserved with 10% formalin in the field. Site habitat conditions were also documented at the time of sampling, which included stream flow, substrate and bank conditions, predominant vegetation, and channel depth and width. Sampling locations and the respective sampling areas are provided below:

- Reference Area 1 (La Sal Creek) – 2.46 m^2,
- Reference Area 2 (Two Mile Creek) – 2.42 m^2,
- Reference Area 3 (Hop Creek) – 2.48 m^2,
- La Sal DN 1 (La Sal Creek, downstream from Firefly/Pigmy Mine) – 1.73 m^2, and
- La Sal DN 3 (La Sal Creek, downstream from Vanadium Queen Mine) – 2.23 m^2.

Samples were shipped to Aquatics Associates, Inc. in Ft. Collins, CO for processing and analysis. Macroinvertebrates were identified and enumerated to the lowest taxonomic level possible using the latest taxonomic keys and references. Following identification and enumeration, a species list including the number of organisms collected were provided for each site. Taxa richness, total density, species diversity, EPT richness (Ephemeroptera, Plecoptera, and Trichoptera), HBI (Hilsenhoff Biotic Index), ICI (Index of Community Integrity, DeShon 1995), B-IBI (Benthic Index of Biotic Integrity, Fore 2001), and other community metrics were also calculated for each site. Macroinvertebrate data and summary metrics are presented Appendix A. Note that these metrics should be used and interpreted with caution because of the overall low macroinvertebrate densities collected from these streams as a sample size of 100 or more organisms is generally recommended (Weber 1973). Two of the five sites, Reference Area 3 and La Sal DN3, had fewer than 100 organisms collected.

Results and Discussion

The macroinvertebrate communities at all sites, except Reference Area 2 (Ref Area 2) on Two Mile Creek, appear to be quite stressed with Ref Areas 1 and 3 (La Sal Creek and Hop Creek, respectively) appearing to be in the worst condition. Overall, densities were low ranging from only 13 to 125 organisms per meter square (organisms/m^2) with the lowest and highest densities at Hop Creek and Two Mile Creek, respectively. Taxa richness ranged from 10 to 28 taxa. The fewest taxa were collected at both Ref Area1 (La Sal Creek) and Ref Area 3 (Hop Creek), with the most taxa collected at Ref Area 2 (Two Mile Creek). Species diversity was very low at Ref Area 1 (0.66), but was relatively high at Ref Area 2 (4.02). Otherwise diversity values were moderate for the other three sites with values between 2.56 and 3.32 (Appendix A). The preponderance of amphipods at Ref Area 1 was the reason for the very low diversity at this site.

HBI values are intended to measure community responses to organic pollution (values ranging from 0 to 10 with higher values (>6) indicating the most stress). HBI results indicate that the macroinvertebrate community in Hop Creek was the most stressed (HBI 6.77), while the least stressed community was in Two Mile Creek (HBI 2.51). Although stress from organic pollution is likely minimal in these streams, this index is a useful measure of the relative tolerance of organisms present at each site.

EPT values are good indicators of environmental stress on macroinvertebrates, especially from metals contamination. The EPT index represents the number of distinct taxa within the three orders, Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), which are highly sensitive to metals pollution. EPT richness generally increases as water quality conditions improve. Two Mile Creek had the highest EPT value (19). The lowest values were at Ref Area 1 (EPT of 2) and Ref Area 3 (EPT of 3). The two downstream sites, La Sal DN1 and DN3 also had low EPT values of 9 and 8, respectively.

The ICI and B-IBI indices incorporate various individual metrics and summarize the overall health of a macroinvertebrate community with respect to metals and other environmental perturbations. ICI scores ranged from 12 (*poor*) at Ref Area 1 to 44 (*good*) at Ref Area 2 on Two Mile Creek. For B-IBI values, three sites were impaired and had the same low score of 7 (*poor*). These sites included Ref Areas 1 and 3 and La Sal DN3. The highest B-IBI score was 19 (*fair*), which again was recorded at Ref Area 2.

The healthiest macroinvertebrate community was found at Ref Area 2 on Two Mile Creek. The overall higher metric scores found at this site are due to the relatively high numbers of mayflies, stoneflies, and caddisflies with most of these taxa collected being very intolerant of metals and other environmental stresses. The most impaired communities were at Ref Areas 1 and 3, and to a lesser extent, sites La Sal DN1 and DN3. These communities had either very few taxa (only 10 taxa at Ref Areas 1 and 3), or the majority of species collected were moderate to highly tolerant organisms at La Sal DN1 and DN3 (even though the number of taxa was higher with 22 and 21 taxa).

In La Sal Creek, the dominant species at Ref Area 1 was the amphipod *Gammarus lacustris*, which comprised nearly 92% of the total population. This species was also the dominant organism at the downstream site (La Sal DN1) but comprised less of the total community with a percent relative abundance (%RA) of 38.7. At site DN1, however, the stonefly *Zapada cinctipes* and the mayfly *Baetis magnus* were also relatively abundant at 23.1 and 12.4%RA, respectively. The presence of these species indicates that habitat conditions for macroinvertebrates are undoubtedly better at the downstream site (i.e., higher flows, presence of riffles with cobble and gravel substrates) than at Ref Area 1. Habitat conditions are generally poorer at Ref Area 1 due to the scarcity of riffle habitat and predominance of pool habitats with soft organic substrates, which limit colonization, especially for the more sensitive species of mayflies, stoneflies, and caddisflies that prefer flowing water.

Ref Area 2 on Two Mile Creek was by far the healthiest of all the sites studied. At this site, EPT taxa comprised 82.5% of the macroinvertebrate community, with the dominant taxon the stonefly *Zapada cinctipes*, which had a relative abundance of 17.2%. The predominant mayfly taxon was *Baetis tricaudatus*, which is moderately pollution tolerant, while the predominant caddisfly was the moderately tolerant species *Hydropsyche* sp. Other very sensitive taxa collected included the mayfly *Paraleptophlebia* sp. and the dipteran *Pericoma* sp. The presence of riffles with a good mix of substrates consisting of sand, coarse gravels and small cobbles, clear water, and possibly more stable flows are likely the major contributing factors supporting a healthy macroinvertebrate community at this site.

The macroinvertebrate community at Ref Area 3 on Hop Creek was impaired. The community was dominated by the mayfly *Callibaetis* sp., which is one of the few tolerant mayflies that can live in stressful environmental conditions. Interestingly, two specimens of the sensitive mayfly *Paraleptophlebia* sp. were also collected at this site. Otherwise, the community was comprised mainly of dipterans (35.5%), most of which were chironomids (midges) that accounted for 25.8% of the benthic fauna. Poor substrate conditions (thin layers of sediment overlying bedrock), very low flows (0.01 cfs in October 2004), and possibly turbid water conditions are likely major factors limiting macroinvertebrate production at this site.

At site DN3 on La Sal Creek, the dominant macroinvertebrates were the mayfly *Baetis tricaudatus* (31.7%) and the black fly *Simulium* sp. (23.2%). Capniid stoneflies were also somewhat abundant comprising about 6% of the community, while only three caddisfly specimens were collected. Macroinvertebrate colonization and overall productivity at this site is hindered by physical stream characteristics such as channelization and the high energy, bottom-scouring flows that can dislodge and "wash out" benthic organisms.

In summary, study results show that two of the three reference sites were in poorer condition than their respective downstream sites (i.e., sites DN1 and DN3 below the mines). Ref Area 2 on Two Mile Creek supports a healthy benthic fauna, which is most likely representative of an unimpaired aquatic macroinvertebrate community for the La Sal Creek Watershed. Consequently, we recommend that site Ref Area 2 serve as the reference site for all sites downstream from the mining disturbances. If Ref Areas 1 and 3 continue to be used as reference sites, we suggest shifting these study reaches either up or downstream to areas of better macroinvertebrate habitat if possible. Further review of the data indicates that physical habitat conditions (rather than water quality conditions) such a paucity of riffle habitat with suitable substrates, low flows, and occasional high energy, substrate-scouring flows are major limitations to macroinvertebrate community development.

Recommendations

1) Ref Area 2 on Two Mile Creek should be used as the reference site for comparison to sites downstream from past mining operations, and possibly consider either discontinuing sampling at Ref Areas 1 and 3, or shifting sample reaches to those with more suitable benthic invertebrate habitat.

2) Quantitative sampling using a modified Hess sampler is recommended for future sampling events as the current methodology (kick net) is semi-quantitative at best. In addition to one composite Hess sample, one supplemental qualitative sample (using either D-frame or kick screen) should be collected to document organisms from all representative habitat types.

3) In order to ensure the most effective sampling (method) and the most appropriate stream areas are chosen for sampling, we suggest having a senior aquatic biologist from Aquatics Associates, Inc. assist with future sampling efforts.

References

DeShon, J. E. 1995. Development and applications of the invertebrate community index (ICI). Pages 217-243 In Davis, W.S. and T. Simon (eds.), Biological assessment and criteria: tools for water resource planning and decision making. Lewis Publishers, Boca Raton, Florida.

Fore, L. S. 2001. Development and application of a biological index to assess the influence of heavy metals on stream invertebrates in mineralized areas of Colorado. Final report, March 2001. Prepared for U.S. Environmental Protection Agency, Region 8, Denver, Colorado.

Weber, C.I. 1973. Biological field and laboratory methods for measuring the quality of surface waters and effluents. EPA-670/4-73-001. National Environmental Research Center, U.S. Environmental Protection Agency, Cincinnati, Ohio.

Appendix A

Macroinvertebrate Community Data

MACROINVERTEBRATE SUMMARY DATA

Community Metrics	La Sal Cr Ref Area 1	Two Mile Cr Ref Area 2	Hop Cr Ref Area 3	La Sal Cr La Sal DN1	La Sal Cr La Sal DN3
Total Density (N/m^2)	92	125	13	108	37
Diversity (d)	0.66	4.02	2.56	2.88	3.32
Total Number of Taxa	10	28	10	22	21
No. EPT taxa	2	19	3	9	8
No. Ephemeroptera taxa	1	6	2	3	3
No. Plecoptera taxa	0	6	0	4	3
No. Trichoptera taxa	1	7	1	2	2
% EPT	0.88	82.51	64.52	41.94	48.78
% Ephemeroptera	0.44	27.39	54.84	15.05	35.37
No. Intolerant taxa	3	18	3	7	8
% Tolerant Organisms	3.98	0.33	54.84	1.08	1.22
% Dominant Taxon	91.59	17.16	48.39	38.71	31.71
HBI	4.14	2.51	6.77	3.60	4.72
% Filterers	2.21	11.55	3.23	2.69	25.61
% Scrapers	0.00	7.92	9.68	4.30	2.44
% Predators	2.65	14.19	9.68	6.45	6.10
% Shredders	0.44	31.02	12.90	27.96	19.51
No. Clinger taxa	2	15	2	6	7
% Clingers	0.88	47.52	12.90	8.60	41.46
No. Diptera taxa	3	4	7	6	8
No. Chironomidae taxa	0	0	4	1	3
% Diptera	2.65	3.30	35.48	10.75	41.46
% Chironomidae	0.00	0.00	25.81	0.54	12.20
% Tribe Tanytarsini	0.00	0.00	0.00	0.00	0.00
ICI	12	44	18	26	34
B-IBI	7	19	7	9	7
Relative Abundance by Order					
TURBELLARIA	0.88	0.00	0.00	0.54	0.00
OLIGOCHAETA	1.77	0.00	0.00	1.08	1.22
AMPHIPODA	91.59	0.00	0.00	38.71	1.22
ACARI	0.00	0.33	0.00	0.00	0.00
EPHEMEROPTERA	0.44	27.39	54.84	15.05	35.37
ODONATA	0.44	0.33	0.00	0.00	0.00
PLECOPTERA	0.00	32.01	0.00	25.81	9.76
TRICHOPTERA	0.44	23.10	9.68	1.08	3.66
COLEOPTERA	0.00	13.53	0.00	6.99	7.32
DIPTERA	2.65	3.30	35.48	10.75	41.46
BIVALVIA	1.77	0.00	0.00	0.00	0.00
Totals:	100.00	100.00	100.00	100.00	100.00
Density by Order					
TURBELLARIA	1	0	0	1	0
OLIGOCHAETA	2	0	0	1	0
AMPHIPODA	84	0	0	42	0
ACARI	0	0	0	0	0
EPHEMEROPTERA	0	34	7	16	13
ODONATA	0	0	0	0	0
PLECOPTERA	0	40	0	28	4
TRICHOPTERA	0	29	1	1	1
COLEOPTERA	0	17	0	8	3
DIPTERA	2	4	4	12	15
BIVALVIA	2	0	0	0	0
Totals:	92	125	13	108	37

La Sal Creek Reference Area 1

Sample Date: 14 October 2004

Taxon	D-frame Composite n	D-frame Composite N/m^2	Relative Abundance (%)
TURBELLARIA			
Dugesia sp.	2	0.81	0.88
OLIGOCHAETA			
Lumbricidae	4	1.63	1.77
AMPHIPODA			
Gammarus lacustris	207	84.15	91.59
ACARI			
Atractides sp.			
EPHEMEROPTERA			
Ameletus sp.			
Baetis magnus			
Baetis tricaudatus			
Callibaetis sp.			
Cinygmula sp.			
Diphetor hageni			
Ephemerella sp.			
Paraleptophlebia sp.	1	0.41	0.44
ODONATA			
Cordulegaster	1	0.41	0.44
PLECOPTERA			
Amphinemura banksi			
Capniidae			
Hesperoperla pacifica			
Isoperla sp.			
Perlodidae			
Pteronarcella badia			
Zapada cinctipes			
TRICHOPTERA			
Arctopsyche grandis			
Brachycentrus americanus			
Glossosoma sp.			
Hesperophylax sp.			
Hydropsyche sp.			
Lepidostoma sp.			
Micrasema sp.			
Oecetis sp.	1	0.41	0.44
Rhyacophila brunnea			
COLEOPTERA			
Anacaena sp.			
Cleptelmis ornata			
Elodes sp.			
Optioservus sp.			
Zaitzevia parvula			

La Sal Creek Reference Area 1

Taxon	D-frame Composite n	N/m^2	Relative Abundance (%)
DIPTERA			
Cricotopus/Orthocladius sp.			
Diamesa sp.			
Dixa sp.			
Euparyphus sp.			
Hexatoma sp.	4	1.63	1.77
Parametriocnemus sp.			
Pericoma sp.			
Phaenopsectra sp.			
Ptychoptera sp.			
Radotanypus sp.			
Simulium sp.	1	0.41	0.44
Tabanus sp.			
Tipula sp.	1	0.41	0.44
Zavrelimyia sp.			
BIVALVIA			
Pisidium sp.	4	1.63	1.77
Totals:	226	91.87	100.00

Total Density (N/m^2)	92
Total Number of Taxa	10
Diversity (d)	0.66

La Sal Creek Reference Area 1

Community Metrics	
Total Density (N/m^2)	92
Diversity (d)	0.66
Total Number of Taxa	10
No. EPT taxa 1/0/1	2
No. Ephemeroptera taxa	1
No. Plecoptera taxa	0
No. Trichoptera taxa	1
% EPT	0.88
% Ephemeroptera	0.44
No. Intolerant taxa	3
% Tolerant Organisms	3.98
% Dominant Taxon	91.59
HBI	4.14
% Filterers	2.21
% Scrapers	0.00
% Predators	2.65
% Shredders	0.44
No. Clinger taxa	2
% Clingers	0.88
No. Diptera taxa	3
No. Chironomidae taxa	0
% Diptera	2.65
% Chironomidae	0.00
% Tribe Tanytarsini	0.00
ICI	12
B-IBI	7

Relative Abundance by Order	
TURBELLARIA	0.88
OLIGOCHAETA	1.77
AMPHIPODA	91.59
ACARI	0.00
EPHEMEROPTERA	0.44
ODONATA	0.44
PLECOPTERA	0.00
TRICHOPTERA	0.44
COLEOPTERA	0.00
DIPTERA	2.65
BIVALVIA	1.77
Totals:	100.00

Density by Order	
TURBELLARIA	1
OLIGOCHAETA	2
AMPHIPODA	84
ACARI	0
EPHEMEROPTERA	0
ODONATA	0
PLECOPTERA	0
TRICHOPTERA	0
COLEOPTERA	0
DIPTERA	2
BIVALVIA	2
Totals:	92

Two Mile Creek Reference Area 2

Sample Date: 20 October 2004

Taxon	D-frame Composite n	N/m^2	Relative Abundance (%)
TURBELLARIA			
Dugesia sp.			
OLIGOCHAETA			
Lumbricidae			
AMPHIPODA			
Gammarus lacustris			
ACARI			
Atractides sp.	1	0.41	0.33
EPHEMEROPTERA			
Ameletus sp.	26	10.74	8.58
Baetis magnus			
Baetis tricaudatus	36	14.88	11.88
Callibaetis sp.			
Cinygmula sp.	3	1.24	0.99
Diphetor hageni	5	2.07	1.65
Ephemerella sp.	1	0.41	0.33
Paraleptophlebia sp.	12	4.96	3.96
ODONATA			
Cordulegaster	1	0.41	0.33
PLECOPTERA			
Amphinemura banksi			
Capniidae	6	2.48	1.98
Hesperoperla pacifica	18	7.44	5.94
Isoperla sp.	8	3.31	2.64
Perlodidae	8	3.31	2.64
Pteronarcella badia	5	2.07	1.65
Zapada cinctipes	52	21.49	17.16
TRICHOPTERA			
Arctopsyche grandis	3	1.24	0.99
Brachycentrus americanus	1	0.41	0.33
Glossosoma sp.	1	0.41	0.33
Hesperophylax sp.			
Hydropsyche sp.	31	12.81	10.23
Lepidostoma sp.	10	4.13	3.30
Micrasema sp.	21	8.68	6.93
Oecetis sp.			
Rhyacophila brunnea	3	1.24	0.99
COLEOPTERA			
Anacaena sp.			
Cleptelmis ornata	16	6.61	5.28
Elodes sp.			
Optioservus sp.	20	8.26	6.60
Zaitzevia parvula	5	2.07	1.65

Two Mile Creek Reference Area 2

Taxon	D-frame Composite n	N/m^2	Relative Abundance (%)
DIPTERA			
Cricotopus/Orthocladius sp.			
Diamesa sp.			
Dixa sp.	1	0.41	0.33
Euparyphus sp.			
Hexatoma sp.	4	1.65	1.32
Parametriocnemus sp.			
Pericoma sp.	2	0.83	0.66
Phaenopsectra sp.			
Ptychoptera sp.	3	1.24	0.99
Radotanypus sp.			
Simulium sp.			
Tabanus sp.			
Tipula sp.			
Zavrelimyia sp.			
BIVALVIA			
Pisidium sp.			
Totals:	303	125.21	100.00

Total Density (N/m^2)	125
Total Number of Taxa	28
Diversity (d)	4.02

Two Mile Creek Reference Area 2

Community Metrics	
Total Density (N/m^2)	125
Diversity (d)	4.02
Total Number of Taxa	28
No. EPT taxa 6/6/7	19
No. Ephemeroptera taxa	6
No. Plecoptera taxa	6
No. Trichoptera taxa	7
% EPT	82.51
% Ephemeroptera	27.39
No. Intolerant taxa	18
% Tolerant Organisms	0.33
% Dominant Taxon	17.16
HBI	2.51
% Filterers	11.55
% Scrapers	7.92
% Predators	14.19
% Shredders	31.02
No. Clinger taxa	15
% Clingers	47.52
No. Diptera taxa	4
No. Chironomidae taxa	0
% Diptera	3.30
% Chironomidae	0.00
% Tribe Tanytarsini	0.00
ICI	44
B-IBI	19

Relative Abundance by Order	
TURBELLARIA	0.00
OLIGOCHAETA	0.00
AMPHIPODA	0.00
ACARI	0.33
EPHEMEROPTERA	27.39
ODONATA	0.33
PLECOPTERA	32.01
TRICHOPTERA	23.10
COLEOPTERA	13.53
DIPTERA	3.30
BIVALVIA	0.00
Totals:	100.00

Density by Order	
TURBELLARIA	0
OLIGOCHAETA	0
AMPHIPODA	0
ACARI	0
EPHEMEROPTERA	34
ODONATA	0
PLECOPTERA	40
TRICHOPTERA	29
COLEOPTERA	17
DIPTERA	4
BIVALVIA	0
Totals:	125

Hop Creek Reference Area 3

Sample Date: 20 October 2004

Taxon	D-frame Composite n	N/m^2	Relative Abundance (%)
TURBELLARIA			
Dugesia sp.			
OLIGOCHAETA			
Lumbricidae			
AMPHIPODA			
Gammarus lacustris			
ACARI			
Atractides sp.			
EPHEMEROPTERA			
Ameletus sp.			
Baetis magnus			
Baetis tricaudatus			
Callibaetis sp.	15	6.05	48.39
Cinygmula sp.			
Diphetor hageni			
Ephemerella sp.			
Paraleptophlebia sp.	2	0.81	6.45
ODONATA			
Cordulegaster			
PLECOPTERA			
Amphinemura banksi			
Capniidae			
Hesperoperla pacifica			
Isoperla sp.			
Perlodidae			
Pteronarcella badia			
Zapada cinctipes			
TRICHOPTERA			
Arctopsyche grandis			
Brachycentrus americanus			
Glossosoma sp.			
Hesperophylax sp.	3	1.21	9.68
Hydropsyche sp.			
Lepidostoma sp.			
Micrasema sp.			
Oecetis sp.			
Rhyacophila brunnea			
COLEOPTERA			
Anacaena sp.			
Cleptelmis ornata			
Elodes sp.			
Optioservus sp.			
Zaitzevia parvula			

Hop Creek Reference Area 3

Taxon	D-frame Composite n	N/m^2	Relative Abundance (%)
DIPTERA			
Cricotopus/Orthocladius sp.			
Diamesa sp.	2	0.81	6.45
Dixa sp.			
Euparyphus sp.			
Hexatoma sp.	1	0.40	3.23
Parametriocnemus sp.	1	0.40	3.23
Pericoma sp.			
Phaenopsectra sp.	3	1.21	9.68
Ptychoptera sp.			
Radotanypus sp.			
Simulium sp.	1	0.40	3.23
Tabanus sp.			
Tipula sp.	1	0.40	3.23
Zavrelimyia sp.	2	0.81	6.45
BIVALVIA			
Pisidium sp.			
Totals:	31	12.50	100.00

Total Density (N/m^2)	13
Total Number of Taxa	10
Diversity (d)	2.56

Hop Creek Reference Area 3

Community Metrics	
Total Density (N/m^2)	13
Diversity (d)	2.56
Total Number of Taxa	10
No. EPT taxa 2/0/1	3
No. Ephemeroptera taxa	2
No. Plecoptera taxa	0
No. Trichoptera taxa	1
% EPT	64.52
% Ephemeroptera	54.84
No. Intolerant taxa	3
% Tolerant Organisms	54.84
% Dominant Taxon	48.39
HBI	6.77
% Filterers	3.23
% Scrapers	9.68
% Predators	9.68
% Shredders	12.90
No. Clinger taxa	2
% Clingers	12.90
No. Diptera taxa	7
No. Chironomidae taxa	4
% Diptera	35.48
% Chironomidae	25.81
% Tribe Tanytarsini	0.00
ICI	18
B-IBI	7

Relative Abundance by Order	
TURBELLARIA	0.00
OLIGOCHAETA	0.00
AMPHIPODA	0.00
ACARI	0.00
EPHEMEROPTERA	54.84
ODONATA	0.00
PLECOPTERA	0.00
TRICHOPTERA	9.68
COLEOPTERA	0.00
DIPTERA	35.48
BIVALVIA	0.00
Totals:	100.00

Density by Order	
TURBELLARIA	0
OLIGOCHAETA	0
AMPHIPODA	0
ACARI	0
EPHEMEROPTERA	7
ODONATA	0
PLECOPTERA	0
TRICHOPTERA	1
COLEOPTERA	0
DIPTERA	4
BIVALVIA	0
Totals:	13

La Sal Creek La Sal DN1

Sample Date: 19 October 2004

Taxon	D-frame Composite n	N/m^2	Relative Abundance (%)
TURBELLARIA			
Dugesia sp.	1	0.58	0.54
OLIGOCHAETA			
Lumbricidae	2	1.16	1.08
AMPHIPODA			
Gammarus lacustris	72	41.62	38.71
ACARI			
Atractides sp.			
EPHEMEROPTERA			
Ameletus sp.			
Baetis magnus	23	13.29	12.37
Baetis tricaudatus	2	1.16	1.08
Callibaetis sp.			
Cinygmula sp.			
Diphetor hageni			
Ephemerella sp.			
Paraleptophlebia sp.	3	1.73	1.61
ODONATA			
Cordulegaster			
PLECOPTERA			
Amphinemura banksi	1	0.58	0.54
Capniidae	3	1.73	1.61
Hesperoperla pacifica			
Isoperla sp.	1	0.58	0.54
Perlodidae			
Pteronarcella badia			
Zapada cinctipes	43	24.86	23.12
TRICHOPTERA			
Arctopsyche grandis			
Brachycentrus americanus			
Glossosoma sp.			
Hesperophylax sp.			
Hydropsyche sp.	1	0.58	0.54
Lepidostoma sp.	1	0.58	0.54
Micrasema sp.			
Oecetis sp.			
Rhyacophila brunnea			
COLEOPTERA			
Anacaena sp.	1	0.58	0.54
Cleptelmis ornata			
Elodes sp.	3	1.73	1.61
Optioservus sp.	8	4.62	4.30
Zaitzevia parvula	1	0.58	0.54

La Sal Creek La Sal DN1

Taxon	D-frame Composite n	N/m^2	Relative Abundance (%)
DIPTERA			
Cricotopus/Orthocladius sp.	1	0.58	0.54
Diamesa sp.			
Dixa sp.			
Euparyphus sp.	2	1.16	1.08
Hexatoma sp.	9	5.20	4.84
Parametriocnemus sp.			
Pericoma sp.			
Phaenopsectra sp.			
Ptychoptera sp.			
Radotanypus sp.			
Simulium sp.	4	2.31	2.15
Tabanus sp.	1	0.58	0.54
Tipula sp.	3	1.73	1.61
Zavrelimyia sp.			
BIVALVIA			
Pisidium sp.			
Totals:	186	107.51	100.00
Total Density (N/m^2)		108	
Total Number of Taxa		22	
Diversity (d)		2.88	

La Sal Creek La Sal DN1

Community Metrics	
Total Density (N/m^2)	108
Diversity (d)	2.88
Total Number of Taxa	22
No. EPT taxa 3/4/2	9
No. Ephemeroptera taxa	3
No. Plecoptera taxa	4
No. Trichoptera taxa	2
% EPT	41.94
% Ephemeroptera	15.05
No. Intolerant taxa	7
% Tolerant Organisms	1.08
% Dominant Taxon	38.71
HBI	3.60
% Filterers	2.69
% Scrapers	4.30
% Predators	6.45
% Shredders	27.96
No. Clinger taxa	6
% Clingers	8.60
No. Diptera taxa	6
No. Chironomidae taxa	1
% Diptera	10.75
% Chironomidae	0.54
% Tribe Tanytarsini	0.00
ICI	26
B-IBI	9

Relative Abundance by Order	
TURBELLARIA	0.54
OLIGOCHAETA	1.08
AMPHIPODA	38.71
ACARI	0.00
EPHEMEROPTERA	15.05
ODONATA	0.00
PLECOPTERA	25.81
TRICHOPTERA	1.08
COLEOPTERA	6.99
DIPTERA	10.75
BIVALVIA	0.00
Totals:	100.00

Density by Order	
TURBELLARIA	1
OLIGOCHAETA	1
AMPHIPODA	42
ACARI	0
EPHEMEROPTERA	16
ODONATA	0
PLECOPTERA	28
TRICHOPTERA	1
COLEOPTERA	8
DIPTERA	12
BIVALVIA	0
Totals:	108

La Sal Creek La Sal DN3

Sample Date: 19 October 2004

Taxon	D-frame Composite n	N/m^2	Relative Abundance (%)
TURBELLARIA			
Dugesia sp.			
OLIGOCHAETA			
Lumbricidae	1	0.45	1.22
AMPHIPODA			
Gammarus lacustris	1	0.45	1.22
ACARI			
Atractides sp.			
EPHEMEROPTERA			
Ameletus sp.			
Baetis magnus	2	0.90	2.44
Baetis tricaudatus	26	11.66	31.71
Callibaetis sp.			
Cinygmula sp.			
Diphetor hageni			
Ephemerella sp.			
Paraleptophlebia sp.	1	0.45	1.22
ODONATA			
Cordulegaster			
PLECOPTERA			
Amphinemura banksi			
Capniidae	5	2.24	6.10
Hesperoperla pacifica			
Isoperla sp.			
Perlodidae			
Pteronarcella badia	1	0.45	1.22
Zapada cinctipes	2	0.90	2.44
TRICHOPTERA			
Arctopsyche grandis			
Brachycentrus americanus			
Glossosoma sp.			
Hesperophylax sp.			
Hydropsyche sp.	2	0.90	2.44
Lepidostoma sp.			
Micrasema sp.	1	0.45	1.22
Oecetis sp.			
Rhyacophila brunnea			
COLEOPTERA			
Anacaena sp.	1	0.45	1.22
Cleptelmis ornata	3	1.35	3.66
Elodes sp.			
Optioservus sp.	2	0.90	2.44
Zaitzevia parvula			

La Sal Creek La Sal DN3

Taxon	D-frame Composite n	N/m^2	Relative Abundance (%)
DIPTERA			
Cricotopus/Orthocladius sp.	6	2.69	7.32
Diamesa sp.	2	0.90	2.44
Dixa sp.	1	0.45	1.22
Euparyphus sp.	1	0.45	1.22
Hexatoma sp.	2	0.90	2.44
Parametriocnemus sp.			
Pericoma sp.			
Phaenopsectra sp.			
Ptychoptera sp.			
Radotanypus sp.	2	0.90	2.44
Simulium sp.	19	8.52	23.17
Tabanus sp.			
Tipula sp.	1	0.45	1.22
Zavrelimyia sp.			
BIVALVIA			
Pisidium sp.			
Totals:	82	36.77	100.00
Total Density (N/m^2)		37	
Total Number of Taxa		21	
Diversity (d)		3.32	

La Sal Creek La Sal DN3

Community Metrics	
Total Density (N/m^2)	37
Diversity (d)	3.32
Total Number of Taxa	21
No. EPT taxa 3/3/2	8
No. Ephemeroptera taxa	3
No. Plecoptera taxa	3
No. Trichoptera taxa	2
% EPT	48.78
% Ephemeroptera	35.37
No. Intolerant taxa	8
% Tolerant Organisms	1.22
% Dominant Taxon	31.71
HBI	4.72
% Filterers	25.61
% Scrapers	2.44
% Predators	6.10
% Shredders	19.51
No. Clinger taxa	7
% Clingers	41.46
No. Diptera taxa	8
No. Chironomidae taxa	3
% Diptera	41.46
% Chironomidae	12.20
% Tribe Tanytarsini	0.00
ICI	34
B-IBI	7

Relative Abundance by Order	
TURBELLARIA	0.00
OLIGOCHAETA	1.22
AMPHIPODA	1.22
ACARI	0.00
EPHEMEROPTERA	35.37
ODONATA	0.00
PLECOPTERA	9.76
TRICHOPTERA	3.66
COLEOPTERA	7.32
DIPTERA	41.46
BIVALVIA	0.00
Totals:	100.00

Density by Order	
TURBELLARIA	0
OLIGOCHAETA	0
AMPHIPODA	0
ACARI	0
EPHEMEROPTERA	13
ODONATA	0
PLECOPTERA	4
TRICHOPTERA	1
COLEOPTERA	3
DIPTERA	15
BIVALVIA	0
Totals:	37